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ABSTRACT

This mathematics teacher's manual contains ten sample lessons on population growth and demography that were adapted from materials produced in several countries in Asia and Oceania. Among the mathematics concepts and skills students apply during these lessons are set theory, cardinal and ordinal numbers, frequency tallies, percentages, ratios, averages, inequalities, and the use of graphs and tables. Activities are designed for lower primary through high school students. Topics investigated include family size, fertility rates, age-sex pyramids, dependency ratios, and population projections. A scope and sequence chart illustrates how teachers can integrate population-related issues into the regular mathematics curriculum. (WB)

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population education in MATHEMATICS

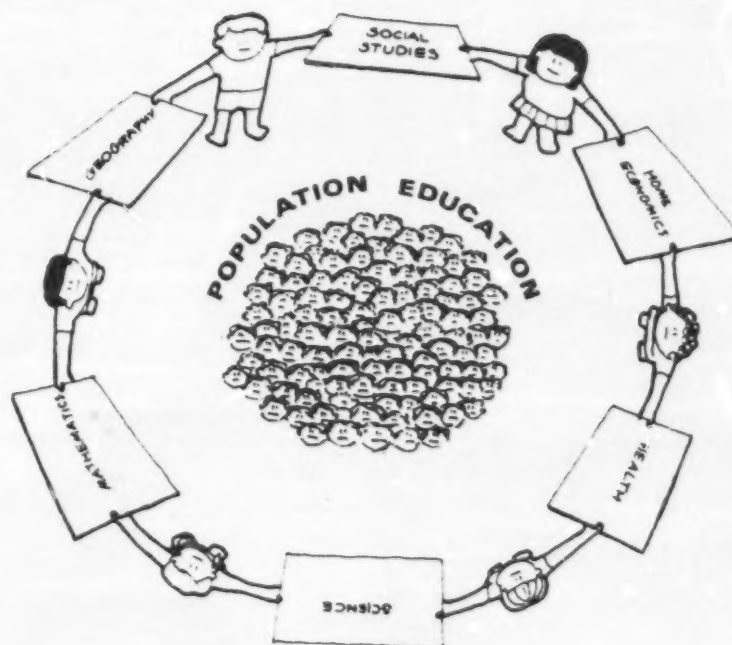
some sample lessons

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POPULATION EDUCATION IN MATHEMATICS

Many of the demographic concepts and population statistics lend themselves to the teaching of mathematics. Population education partly systematizes the most relevant parts of that large body of mathematical theory concerned with the growth processes of human and animal population. Mathematics is principally concerned with the principles of enumeration and rate, sizes and patterns, addition and subtraction of decimals, operations and properties of real numbers, systems of equation and inequalities, sets and subsets, expanded notation, place value chart and others. More concrete examples of relationships are given below.

1. In connection with relations and graphs, various population-related activities are possible, using birth rates and death rates. For example, taking the years from 1960 to 1968, the years may be located on the x-axis and the birth rates and death rates on the y-axis. The gap on the graph between the line showing the birth rates and the line showing the death rates will indicate the rate of natural increase.

2. The study of sets and subsets can be related to members of the family and its size; the sequencing of the family members can be studied through the ordinal numbers; and the notion of dependence can be studied by dividing the number of family members who are not working by the number of family members who are working.

3. The simple principle of addition and subtraction can be applied also on migration by showing that when a certain number of people from one place migrate to another place, we add that number to the population of the place of destination. We subtract the same number from the population of the place they had left.

In addition to simple notions about family size and migration, mathematics can be applied to some of the procedures of demographic analysis. For example, what are the factors that cause demographic changes? How do different assumptions regarding fertility and mortality affect population increase and ~~more~~ particularly the age structure of a population? How does a population age or grow young? What are the implications of different age structures for national expenditure? What economic problems can arise from different age structures?

The end result of integrating population education concepts into mathematics will be the acquisition by the student of a sound understanding of the basic demographic indices and the rationale underlying their computation and comprehension of a live social phenomenon such as the growth of population.

5. POPULATION EDUCATION IN MATHEMATICS

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V. SCOPE AND SEQUENCE OF POPULATION EDUCATION CONCEPTS AS INTEGRATED INTO
 MATHEMATICS SUBJECT: CONSOLIDATED FROM SCOPE AND SEQUENCE
 OF MATHEMATICS SYLLABI OF SELECTED ASIAN COUNTRIES
 (Pakistan, Philippines, Republic of Korea, Sri Lanka)

CONCEPTS	SUB-CONCEPTS	OBJECTIVES	GRADE LEVEL			
			Elementary	Middle	High	
			Lower	Upper	Level	School
A. THE FAMILY SIZE	1. Family size, number of family members.*	1. To develop an ability to compare the number of family members by comparing sets by one-to-one correspondence.	X	X		
	2. Number of friends of the family members.*					
	3. Comparison of the number of one's family members with those of friends.*	2. To compare non-equivalent sets in relation to family.	X	X		
	4. Dependents.	3. To count the members of the family using cardinal numbers.	X	X		
	5. Sequence of births.*	4. To identify sets and sub-sets in relation to members of the family.	X	X		
		5. To solve simple problems in addition and subtraction regarding family size.	X	X		
		6. To use ordinal numbers in stating the sequence of the family members according to birth.		X		
		7. To solve practical problems on division regarding money and family size.	X	X	X	X
		8. To identify the equivalent parts of a whole in relation to family size.		X	X	X

CONCEPTS	SUB-CONCEPTS	OBJECTIVES	GRADE LEVEL			
			Elementary		Middle Level	High School
			Lower	Upper		
B. THE SCHOOL POPULATION SIZE (PLACE, VALUE, READING AND WRITING NUMERALS)	1. Number of students in the class-room.*	1. To develop an ability to count and write numbers of students in one's classroom and one's school.	X	X	X	X
	2. Number of male and female students in the classroom.	2. To develop an ability to count the numbers of male and female students in their classes and represent them in numbers.	X	X	X	X
	3. Number of students in one's grade, sex ratio in one's grade.	3. To develop an ability to calculate number.			X	X
	4. Number of students in one's school, sex ratio in one's school.	4. To develop the ability to read and write numerals on school population size through the hundred thousandth.		X	X	X
	5. Increase and decrease in the number of students in one's classroom.	5. To explain the value of each figure in numerals on school population size up to six digits.		X	X	X
C. FEATURE OF A POPULATION (MATHEMATICAL SYMBOLS: OPERATION AND PROPERTIES OF REAL NUMBERS, ORDERING REAL NUMBERS,	1. Population census.*	1. To read and interpret graphs involving dependency ratio.		X	X	
	2. Age-sex distribution in a population pyramid.*	2. To add and subtract in connection with life expectancy.		X	X	
	3. Dependency ratio.*	3. To read, write and interpret mathematical symbols and expressions related to population concepts.				X
	4. Masculinity ratio.	4. To perform the operations of addition and multiplication and their inverses on real number in relation to dependency ratio.				X
	5. Age at marriage.					
	6. Life expectancy.					
	7. Population density.*					
	8. Ratio of population composition in urban and rural areas.					

CONCEPTS	SUB-CONCEPTS	OBJECTIVES	GRADE LEVEL			
			Elementary		Middle	High
			Lower	Upper	Level	School
SUBTRAC- TION OF MIXED DECIMALS RATIO, DI- VISION, MULTIPLICA- TION AND PERCENT- AGE)		5. To extend the application of addi- tion and multiplication and their inverse operations in computing sex ratio and masculinity ratio.			X	X
		6. To arrange the numbers involving sex ratio and population density in either ascending or descending order.			X	X
		7. To use subtraction of mixed deci- mals involving data on life expectancy.			X	X
		8. To find the dependency ratio of whole numbers.			X	X
		9. To find the percentage of using age at marriage.			X	X
		10. To develop an ability to compute the rate of economically active population through the method to calculate ratio of the young and the aged.			X	X
D. POPULATION INCREASE OR COMPO- NENTS OF POPULATION CHANGE (ADDITION AND SUB-	1. Death	1. To use addition and subtraction in solving simple problems in- volving population facts.	X	X	X	X
	2. Birth	2. To read and interpret a pictograph on completed family size and birth.			X	X
	3. Migration	3. To read and interpret a bar graph on death and migration..			X	X
	4. In migration	4. To order numerals involving the number of deaths in a year.			X	X
	5. Out migration					
	6. Net migration					

CONCEPTS	SUB-CONCEPTS	OBJECTIVES	GRADE LEVEL			
			Elementary		Middle Level	High School
			Lower	Upper		
TRACTION, PICTO-GRAPHS, BAR GRAPHS, ORDERING NUMBERS)		5. To add and subtract numbers dealing with number of migrants.		X	X	X
E. DEMOGRAPHIC PROCESSES AND MEASURES (GRAPHICAL REPRESENTATION, ORDER OF OPERATIONS IN A SERIES, OPERATIONS AND PROPERTIES OF REAL NUMBERS, EQUATION AND INEQUALITIES)	1. Fertility/Fecundity.* 2. Mortality.* 3. Migration. 4. Birth rate. 5. Death rate. 6. Migration rate. 7. Rate of natural increase. 8. Growth rate.	1. To be able to compute number of births and deaths per one hundred persons through births per total population and through deaths per total population respectively. 2. To develop an ability to compute birth and death rates and natural increase. 3. To read and interpret graphs and tables based on population data, birth, death rate. 4. To perform the operations of addition and multiplication and their inverse operations in solving problems related to measures of population change. 5. To solve problems involving population concepts by applying the properties of equations and inequalities and equation in two variables.			X	X
					X	X
					X	X
					X	X
					X	X

CONCEPTS	SUB-CONCEPTS	OBJECTIVES	GRADE LEVEL			
			Elementary		Middle Level	High School
			Lower	Upper		
F. PATTERN OF POPULATION CHANGE (RATIO, PROPORTION, PERCENT, DECIMALS, COMMON FRACTIONS, EXPANDED NOTATION, PLACE VALUE CHART, GRAPHING)	1. Geometric progression. 2. Doubling time. 3. Population Projection.*	1. To solve problems involving percentage in connection with population projection.		X	X	
		2. To extend the use of percent in determining life expectancy and solving problems involving population projection, doubling time and related population concepts.			X	X
		3. To compare population projections in selected provinces.	X	X	X	X
		4. To write numerals in a place value chart and expanded notation.		X	X	
		5. To add and subtract numbers involving population size.	X	X		
		6. To interpret and construct line graphs for population projection.		X	X	X
		7. To be able to compute years of the double size of present population through the method of projecting natural increase rate.			X	X

CONTENT : FAMILY SIZE

- OBJECTIVES:
1. To compare sets by one-to-one correspondence.
 2. To compare non-equivalent sets.
 3. To count cardinal numbers by counting members of the family.
 4. To add and subtract numbers to find the size of the family.
 5. To solve practical problems on multiplication and division regarding money and family size.
 6. To identify equivalent parts of a whole.

GRADE LEVEL: LOWER PRIMARY

SCOPE & SEQUENCE NO.: V.A.1; V.A.2; V.A.3; V.A.5

- A. Place two sets of cutouts of figures of family members on the flannel board, one set consisting of father and mother figure cutouts and the other set, figure cutouts of two children.



Have the pupils say:

This is my father.
This is my mother.
This is my brother.
This is my sister.
Brother helps Father,
Sister helps Mother,
And I go to school every day.

Ask:

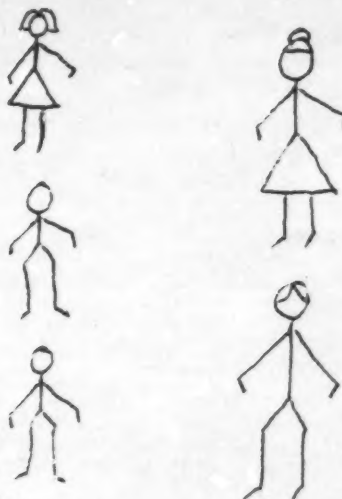
Who are the members of the family? Who helps Father? Who helps Mother? Who goes to school everyday?

Using a piece of string, match the figure cutouts that help each other.

Do the cutouts match one to one? These sets are called *equivalent sets*.

Population Concept: Members of the Family

- A. Draw two sets of pictures of family members on the chalkboard, one set consisting of three children and the other set consisting of Father and Mother.



Have the pupils say:

I have a little brother.
 I have a little sister, too.
 Sister sings with Mother.
 Brother sings with Father.
 With whom may I sing,
 With Brother or Sister, Father or Mother?

Ask:

Who sings with Mother?
 Who sings with Father?
 With whom may you sing?

Draw a line from each member of one set to match the members of the other set. Which set has more members? Which set has less? Do the sets match one to one?

Sets that do not match one to one are called *non-equivalent sets*.

Population Concept: Family Size

Let us sing "Ten Little Indians." I have a similar song. Would you like to listen to the song? It is called "Ten Little Babies". Listen carefully to the words of the song. (Sing: "Ten Little Babies" to the tune of "Ten Little Indians," using cutouts of figures of babies to illustrate the numbers 1 to 10.)

Ten Little Babies

One little, two little, three little babies,
 Four little, five little, six little babies,
 Seven little, eight little, nine little babies,
 Ten little babies all.

Ask:

How many little babies are there?
 Who would like to count from one to ten?
 Have as many children as time permits count from one to ten.

Population Size: Family Size and Addition.

Have the pupils say:

I love my little brother,
I love my sister new,
Sister loves my mother,
My brother loves her, too.
My father loves my mother
He loves his children three;
We all love one another
We're a happy family.

Use pictures of family members to illustrate the rhyme.

Ask:

Who are the members of the family?
How many children are there in the family?
How many members are there in the family?

Have them add the members of the family by saying:

Little brother, little sister, and myself are how many? _____
Three children and father and mother are how many? _____

Population Concept: Family Size and Subtraction.

A STORY PROBLEM

Have the pupils say:

I had two brothers and two sisters before.
My older brother died when he was three.
How many children are we in the family now?

Ask:

How many brothers did I have before?
How many sisters?
How many children were we in all?
How many died? How many children are we now?

Have the class fill in the blanks by saying:

Two brothers and two sisters and myself are how many children?
Five children less one who died leaves _____ children alive.

Population Concepts: Family Size, Births and Ordinal Numbers.

Call on the pupil who comes from the family with the largest number of children.

Say: Tell us the names of all your brothers and sisters from the oldest to the youngest.

As the pupil gives the names, write them in the order in which they are given.

Then say: Let us number them now from the oldest to the youngest.

Write the phrase "the first child" after the first name written on the chalkboard. Underline the word *first*. Follow this procedure for the second and continue through the last name written on the chalkboard. The listing should be like the list below, when completed.

- | | |
|------------------------------------|---------------------------------------|
| 1. Roy - the <u>first</u> child | 6. Gigi - the <u>sixth</u> child |
| 2. Nene - the <u>second</u> child | 7. Tina - the <u>seventh</u> child |
| 3. Manuel - the <u>third</u> child | 8. Danila - the <u>eighth</u> child |
| 4. Rita - the <u>fourth</u> child | 9. Josephine - the <u>ninth</u> child |
| 5. Lulu - the <u>fifth</u> child | 10. Rafael - the <u>tenth</u> child |

Who was born first? Who was born last? Who was born fourth?
 Who was born seventh? Who was born before Rita? Who was
 born before Gigi? Who was born after Roy? After Lulu?
 After Danila?

Call on several pupils using the same procedure.

Population Concept: Family Size and Addition and Subtraction.

Give the class these story problems:

- a. Aling Carmen went to a store. She bought 2 bananas. How many more did she need to be able to give her 3 children one banana each?
- b. Aling Nena went to a store, too. She also bought 2 bananas. How many more did she need to give her 6 children one banana each?

The story problems you just read include a few equations. Who will write these equations on the chalkboard? The equations may be written like the following:

$$\begin{array}{lcl} 3 - 2 = \boxed{} & \text{or} & 2 + \boxed{} = 3 \\ 6 - 2 = \boxed{} & \text{or} & 2 + \boxed{} = 6 \end{array}$$

Who bought more bananas, Aling Nena or Aling Carmen? Why?

Have the class solve the problems and write the answers to the equations.

Population Concept: Family Size and Division Regarding Money.

Give this story problem to the class:

Mang Lino has 2 children and Mang Ponso has 4. They both have 3 pesos each. They want to divide their money equally among their children.

On the flannel board are Mang Lino's children and his 3 pesos in coins.



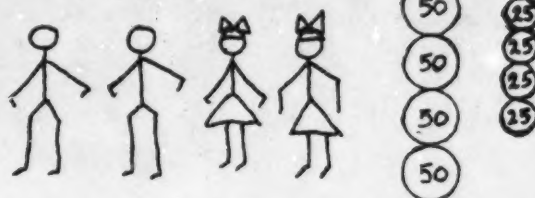
Let's play a game. Pretend that you are Mang Lino. Here are your 2 children.

Points to the cutouts on the flannel board.

Here are 3 pesos in 50- and 25-centavo pieces and here are your 2 children. Divide these equally between the 2. How many 50-centavo pieces does each get? How many 25-centavo pieces?

Do the same with Mang Ponso's family (See illustration.) How many 50-centavo pieces does each get? How many 25-centavo pieces? Which children get more money each - Mang Ponso's or Mang Lino's children? Why?

Which family is large? Small?



Population Concept: Family Size and Identifying the Equivalent Parts of a Whole.

Present these problems in succession:

Ana's mother bought a rice cake. She divided it equally among her 4 children.



1. Into how many equivalent parts was the rice cake divided?
2. What part did each child get?

Pepe's mother has 6 children. She also bought a rice cake as big as that which Ana's mother bought and divided it equally among her 6 children.



1. Into how many equivalent parts was the rice cake divided?
2. What part did Pepe get?

Show cutouts of 2 rice cakes of the same size. Then say:

Here is the rice cake that Ana's mother bought. Into how many equal slices did Ana's mother cut it so that each of her children would have one?

Adapted from: Philippines. Ministry of Education and Culture. Population Education Program. *Teacher's guide in population education for elementary mathematics grades 1-6*. Manila, 1976, p.1-4, 6-8.

CONTENT : FAMILY SIZE AND COMPUTING AVERAGE
NUMBER OF CHILDREN

OBJECTIVES: *To help the pupils become familiar with the construction of a frequency table using data on family size.*

GRADE LEVEL: HIGH SCHOOL

SCOPE & SEQUENCE NO.: V.A.1

Procedures:

1. *What determines the size of a family?*

(The students may answer births, marriage, permanent visitors, etc. The purpose of this question is to begin focussing on data on the number of live children in different families).

2. *What is the number of children born alive to your mother?*

(The students should also include any children who may have died since birth, in answering question 1. Write the figures on the blackboard as the students answer. You will have a series of figures on the blackboard, such as 4, 5, 7, 3, 2, 9)

3. *How many families are there that have 4 children each? 3 children each?*

(Let the students count 4's, 5's for a few minutes).

Is it easy to find this from the list that we wrote on the blackboard? Could you think of any other way of setting out those figures so that it would be easier to find the number of families with one child, 2 children, 3 children, etc.?

(Give some time for the students to think. If the students could come out with a method, represent it on the board and discuss the method of recording the data. If not, ask further question such as the one given below).

What is the largest number of children born alive to a mother?
(Write the number at the top of blackboard).

What is the smallest number of children born alive to a mother?
(Write the figure at the bottom of blackboard. Discuss with pupils about putting the data in a tabular form. If necessary, suggest the following).

Number of children (n)	Tallying of families having the number of children stated in Column 1	Frequency (f)
9	1	1
8	1111	4
7	111 11	7
6	111 111	10
5	111 111 1	11
4	111 111	8
3	111 11	7
2	1	1
1	1	1
		<u>Σf 50</u>

(Introduce the idea of the "gate technique" of tallying in fives as shown in the table above, and the ' Σ ' sign which denotes the sum of all the figures in the column).

Does the table help us to tell quickly the numbers of families with different numbers of children?

(Tell the students that this kind of table is called a "frequency table").

4. *How many children do you expect to have when you will yourselves be the parents?*

(Give the students enough time to think and write the figures on the blackboard. Have students copy these in their worksheet).

Assignment/Evaluation: Prepare a frequency table on the data you copied in the class.

Additional exercises of a similar kind may be given to the pupils. These and the frequency tables above may be utilized for the next lesson.

Lesson 2

Objectives: To help the pupils understand the "mode" and acquire the skill in computing the arithmetical mean from given data or from a frequency table.

Procedures:

1. (Write a pupil's frequency distribution on the blackboard).

What is the most frequently occurring value in respect of the expected number of children?

What is the least frequently occurring value in respect of the expected number of children?

What can we say by looking at the most frequently occurring value?

(Many of you seem to have settled on having that number of children. Tell the pupils that the most frequently occurring value is called the "mode". When there is a range, say 4-6 children, the mid-point of the range, i.e. 5 is usually taken as the "mode". Circle the "mode" in the table. The occurrence of one or a few extremely high (or low) values has no effect on the mode).

2. *How can we describe the characteristics of the group - here the class preference for a certain number of children?*

(Here, pupils need to be reminded that the average (arithmetical mean) value represents the central tendency of the characteristics of the whole group. Elicit from pupils the method of calculating the average value).

How can we calculate the total number of children?

(Multiply the number of children by the frequency. As for instance, if there are four responses, i.e. $f = 4$, to the category of 8 children, the total number of children in that category will be $4 \times 8 = 32$ children).

What is the next step to get the average?

(Divide the total number of children by the total number of families. This gives the average. Complete the table with pupil participation, as shown below.)

No. of children (X)	Tally- ing	f	Xf
9		1	9
8		4	32
7		7	49
6		10	60
5		11	55
4		8	32
3		7	21
2		1	2
1		1	1
		$\Sigma f = 50$	$\Sigma Xf = 261$

$$\begin{aligned}
 \text{Average } (\bar{X}) &= \frac{\Sigma Xf}{\Sigma f} \\
 &= \frac{261}{50} \\
 &= 5.2
 \end{aligned}$$

Tell the pupils what we call the average, "Arithmetical Mean", or simply "Mean". Mean is written as $\bar{X}$. The Mean is a measure of the Central Tendency. It is representative of the measurement of a group as a whole with respect to certain traits. The Arithmetical Mean should be thought of as a computed value and not as a value which actually exists.

3. How does "Mean" help us to describe the characteristics of the group?

Assignment/Evaluation:

Mean and mode computation on the other frequency distributions. What does the mean indicate? Give possible reasons.

Additional exercises of a similar kind may be given to the pupils.

Adapted from: Unesco. Regional Office for Education in Asia. *Population and family education draft sample instructional materials - science/mathematics*. Bangkok, 1971, p. 34-37.

CONTENT : SCHOOL POPULATION SIZE AND CHANGE

OBJECTIVES: 1. *To assess the ability to interpret and analyse information about the impact of population growth on the size of the school population.*
(topic: population consequences--
cognitive level: interpretation)

GRADE LEVEL: UPPER PRIMARY

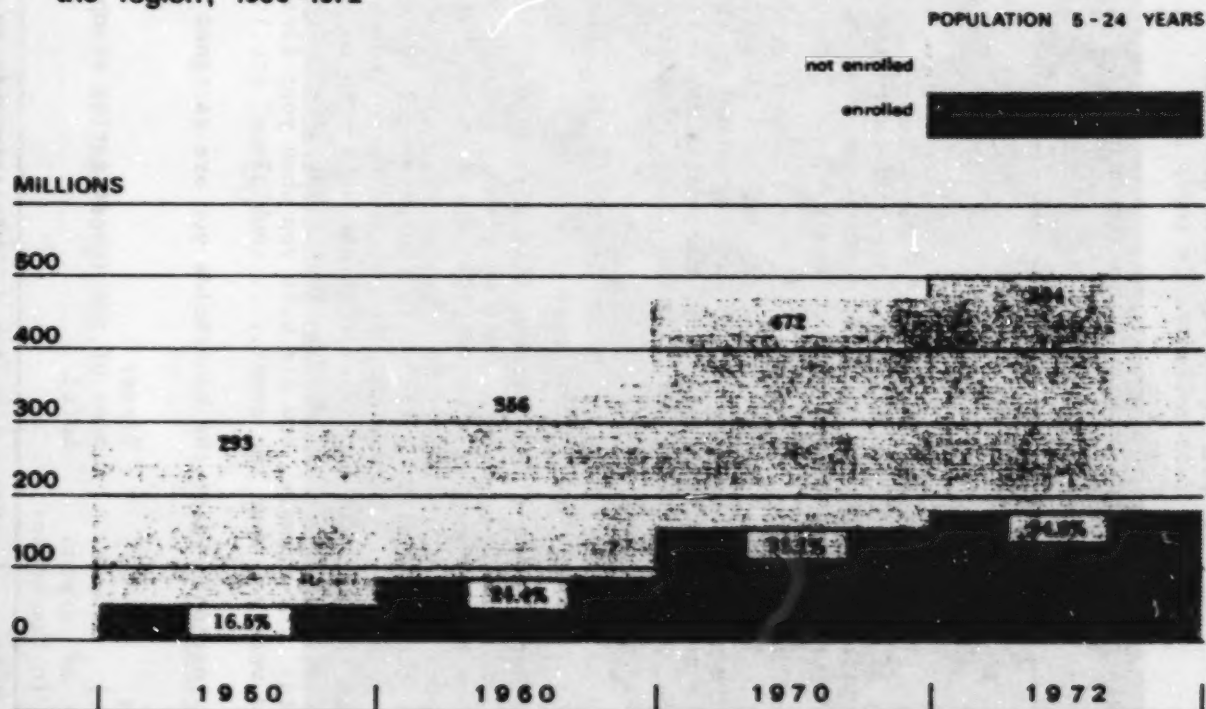
SCOPE & SEQUENCE NO.: V.B.

Study the bar-graph on the next page and answer questions 1-4.

1. What does the graph show?
 - a) The population less than 4 years of age in Asia.
 - b) The population aged 5 to 24 and the number of school children in Asia.
 - c) The population and the number of children not enrolled in school.
 - d) The number of teachers and the population of students aged 5 to 24.
2. Pay particular attention to the length of the bar. What does the bar show in relation to the size of population?
 - a) The population does not change.
 - b) The population is continuously increasing.
 - c) The population is decreasing.
 - d) None of the above.
3. Pay particular attention to the length of the bar. What does the bar show in relation to the population of school children?
 - a) The size of population has not changed.
 - b) The size of the population of school-going age is continuously increasing.
 - c) The size of the school population is decreasing.
 - d) None of the above.
4. What is the effect of rapid population growth on the number of school-children?
 - a) The larger the population, the larger the number of school-children.
 - b) The larger the population, the smaller the number of school-children.
 - c) The increase in population does not affect the number of school-children.
 - d) None of the above.

Adapted from: Philippines. Ministry of Education and Culture. Population Education Program. *Teacher's manual for the self-learning unit in population education, grade 6 (RPG and education)*. Manila, 1976, p. 5-8.

5. Population 5-24 years and enrolment at all levels,
the region, 1950-1972



(Unesco. Regional Office for Education in Asia. *Progress of education in the Asian region. Second statistical supplement.* Bangkok, 1975, p. 17)

CONTENT : POPULATION CENSUS

- OBJECTIVES:**
1. *To help pupils develop skills in collecting data on population of a locality consisting of say, 200 families.*
 2. *To help pupils construct a five-year age-group table using the data collected in their own locality.*

GRADE LEVEL: UPPER PRIMARY/LOWER SECONDARY

SCOPE & SEQUENCE NO.: V.C.1

Procedures:

1. *What is the population situation in the locality?*

(Here, of course, the pupils will have difficulty in answering this vague question. The purpose of the question, however, is to make an entry, with pupils' participation, into the subject of population)

How can we find out about the population size of our locality?

(First, the boundary of the locality must be decided. Then to answer the above question, we could go to each household in the locality, and collect the necessary data. For this, the pupils may work in groups of two or three, according to the size of the class. Assign a certain number of households to each group)

2. *We have decided to go to different households to collect data. What kind of data are we going to collect?*

(As students express their views, list them on the blackboard. If necessary, ask leading questions, such as: Who are the members of a family? Who are the members of a household? Write on the blackboard - number of persons in the household; male or female; ages; relationship to the head of the household. Discuss how these various items may be placed in a tabular form. Settle on a format somewhat like that shown below. Finding the accurate age of persons may be a problem in the villages. Discuss the kinds of question that might be asked when collecting data: for example, how old were you when your first son was born? How old were you when the event.....took place? etc.)

Assignment/Evaluation: Visit the households you are assigned to and collect data.

Locality:

Class:

House No.:

Name of the investigating group:

Total No. of persons

Date:

living in the house:

List the person in serial order from the oldest to the youngest	Sex Male or female	Age (rounded to years)	Relationship to head of the household
Serial No.* (No name)			

* Don't mention temporary visitors in the list.

Procedures:

1. We have collected some data on the population of our locality. We now wish to know how many persons there are in various age groups. Should we put the data using one year intervals of age?

(Have pupils realize that setting out data in one year intervals, will be a lengthy task. Get them to express other age intervals, and discuss the merits and demerits. If necessary, suggest 5-year intervals and have the class consider it).

2. How many five-year intervals are there going to be?

(Arrive at a format somewhat similar to the data-analysis sheet shown below:)

Age group (years)		Tallying	Frequency	Percentage of the total population
70 & over	M			
	F			
65-69	M			
	F			
60-64	M			
	F			
55-59	M			
	F			
50-54	M			
	F			
45-49	M			
	F			
40-44	M			
	F			
35-39	M			
	F			
30-34	M			
	F			
25-29	M			
	F			
20-24	M			
	F			
15-19	M			
	F			
10-14	M			
	F			
5-9	M			
	F			
0-4	M			
	F			

Compiled by Group M = male
F = female

(Have each group of pupils who participated in the survey as described in the previous lesson, work on compiling a table for their own data).

3. Now, how can we put all the data together?

(Have each group report the figures and add them. The teacher could put them on the blackboard. Let the pupils fill up a data sheet such as below).

Assignment/Evaluation:

1. Complete filling up the following data:

Age group	Tallying	Frequency	Percentage
70-80 M			
F			
65-69 M			
F			
60-64 M			
F			
55-59 M			
F			
50-54 M			
F			
45-49 M			
F			
40-44 M			
F			
35-39 M			
F			
30-34 M			
F			
25-29 M			
F			
20-24 M			
F			
15-19 M			
F			
10-14 M			
F			
5-9 M			
F			
0-4 M			
F			

Add a suitable title to the above table.

2. What is the percentage of females in the total population in your locality?
3. What is the ratio of males to females?
4. What percentage of the people in your locality do you consider to be the productive population?

Adapted from: Unesco. Regional Office for Education in Asia. *Population and family education draft sample instructional materials - science/mathematics*. Bangkok, 1971, p. 40-44.

CONTENT : AGE-SEX PYRAMID

OBJECTIVES: *To help pupils construct an age/sex pyramid; to assist them to calculate the dependency ratio.*

GRADE LEVEL: UPPER PRIMARY/LOWER SECONDARY OR
MIDDLE SCHOOL

SCOPE & SEQUENCE NO.: V.C.2

Procedures:

1. (Tell the pupils that we are going to construct an age/sex pyramid. It is a special kind of bar graph. The pyramid reorganizes the bars by representing all men on one side and all women on the other side of the page. The format of the graph is given below:)

Age group	Male	Female
70 & above		
65-69		
60-64		
55-59		
50-54		
45-49		
40-44		
35-39		
30-34		
25-29		
20-24		
15-19		
10-14		
5-9		
0-4		
	10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10	
	percentage	

(Have the students write all the age groups and percentages on the squared paper. Let them construct the pyramid individually).

What are advantages of setting out data in the form of a pyramid?

(It shows clearly the age and sex structure of a population).

2. *What is meant by "Productive" population?*

(People of working age group, i.e. generally 15-60 years).

Refer to certain weaknesses of this definition. For example, children under 15 and old persons over 60 may be active in producing food, etc. while some persons in the 15-60 age group may be non-productive).

What is meant by the non-productive population?

(People under the age of 15 and above the age of 60. Introduce the term "Dependency Ratio". This is the ratio of non-productive population to the productive population. It is calculated by adding the percentages of population under the age of 15 and above the age of 60, dividing this sum by the percentage of population within the age range of 15-60, and then multiplying by 100. The higher the dependency ratios, the greater is the burden on the population of working age group to support the "non-productive" population).

What sorts of things do we need to calculate dependency ratio?
 (The percentage of children under 15 years of age; the percentage of persons over 60 years of age; and the percentage of persons aged 15-60).

Could you put that in the form of a table?

The table will look like:

Age groups in percentages			Dependency ratio
0-14	15-59	60 +	

Assignment/Evaluation:

1. Construct an age-sex pyramid using the data given below:

Age group (years)	Male	Percentage of total population	Age group (years)	Female	Percentage of total population
70 & above		.6	70 & above		.8
65-69		.7	65-69		.7
60-64		1.1	60-64		1.2
55-59		1.2	55-59		1.3
50-54		1.6	50-54		1.7
45-49		2.0	45-49		2.2
40-44		2.4	40-44		2.6
35-39		3.0	35-39		3.1
30-34		3.3	30-34		3.9
25-29		3.9	25-29		4.4
20-24		4.0	20-24		4.5
15-19		4.7	15-19		4.6
10-14		5.5	10-14		5.6
5-9		6.6	5-9		6.6
0-4		8.0	0-4		8.0

Source: CBS, His Majesty's Govt., Nepal, 1968.

Describe briefly the population structure as revealed by the age pyramid.

2. Compute the dependency ratio for the population represented in the following table:

Year	Age groups %			Dependency ratio
	0-14	54.4	60	
1961	40.5	54.4	5.1	
1966	40.4	54.4	5.2	
1971	39.4	55.1	5.5	
1976	38.8	55.5	5.7	
1981	38.8	55.3	5.9	

Source: CBS, Population projection for Nepal, 1968.

Does the dependency ratio indicate any trend?

Excerpted from: Unesco. Regional Office for Education in Asia. *Population and family education draft sample instructional materials - science/mathematics*. Bangkok, 1971, p. 45-48.

CONTENT : POPULATION COMPOSITION: DEPENDENCY RATIO

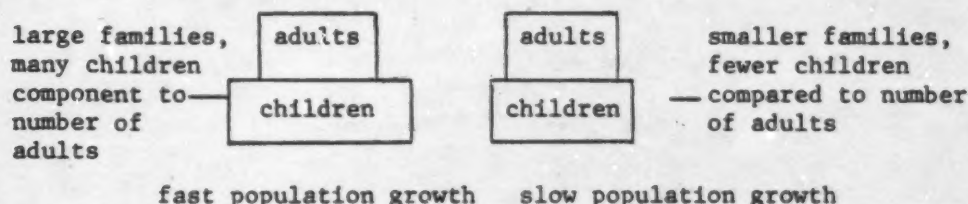
- OBJECTIVES:
1. Define dependency ratio.
 2. Compare and interpret dependency ratios of different countries.
 3. Identify inaccuracies in the definition of dependency ratio as it applies to Malaysia (optional).

GRADE LEVEL: HIGH SCHOOL

SCOPE & SEQUENCE NO.: V.C.3

Reading and activities from student text:

The people in any population have different ages. In fast-growing populations, there are more children compared to the number of adults.



One way of describing the ages of people in a population is the dependency ratio. It is based on the fact that all people--very young, adults, very old--are consumers. But only some people are producers. The dependency ratio describes the part of the population who are not working and therefore depend on those who are working. To be more exact, demographers call the non-working age groups those aged 0 to 14 (too young to work) and those aged 65 and above (too old to work). They define the dependency ratio as the number of people 65 and over and under 15 in relation to those aged 15 to 64.

$$\text{dependency ratio} = \frac{\text{number of people under 15 years} + \text{number of people 65 years and over}}{\text{number of people 15 to 64 years}} \times 100$$

(we multiply by 100 to show the number per 100 people).

The dependency ratio of Sri Lanka (in 1972) was 82. This means that 100 people in the working ages must support themselves plus 82 others.

Exercises:

1. The dependency ratio of the United Kingdom (in 1972) was 59. This means that, on the average, each 100 people in the working ages had to support themselves plus _____ others. (Fill in the blank space).

2. For Malaysia (in 1972) for each 100 people, on the average, there were

- 42 people under 15 years
 - 54 people aged 15 to 64
 - 4 people aged 65 or over.
- What was the dependency ratio?

3. Here are the dependency ratios for five countries (in 1972). In what country do the working age people have to support the greatest number of others? In what country do the working age people have to support the fewest non-working people?

<u>country</u>	<u>dependency ratio (in 1970)</u>
Japan	45
Republic of Korea	79
United Kingdom	59
Malaysia	85
Sri Lanka	82

4. Put the countries named in exercise 3 into two groups:
 (a) those with more economic development and (b) those with less economic development. What can you say about the dependency ratios of these two groups?

Other exercises:

5. Look at the definition of the dependency ratio. Does it accurately show the number of people not employed in Malaysia? What factors does it ignore in a country like Malaysia?

- Answer: - Some people under 15 may be earning.
 - Many people over 15 are still in school, and not earning.
 - Many women of working age are unemployed.
 - Some men of working age are unemployed.
 - Some people over 65 are earning.

6. Do you think the total number of unemployed people in Malaysia is greater or smaller than the number of those below 15 and 65 and above?

TABLE I: POPULATION BY PERCENTAGE WORKING AND NON-WORKING, SELECTED COUNTRIES. (1972)

Country	Percentage in each group		
	under 15	15 to 64	65 and over
Japan	24	69	7
Sweden	21	66	13
U.K.	24	63	13
Germany	24	61	15
New Zealand	33	59	8
S. Korea	40	56	4
Sri Lanka	41	55	4
Malaysia	42	54	4

7. Study the table I above
 a) calculate the percentage of the population of non-working age for each country.
 b) state which countries have high population growth rates.
 c) suggest reasons why Japan has the highest percentage of its population in the working age group.
 d) suggest reasons why Malaysia's population has the lowest percentage of working age.

Excerpted from: Malaysia. Curriculum Development Centre. Population Education Project. *Teacher's guide to population education in civics, forms 4 and 5*. Kuala Lumpur, 1975, p. 3-6.

CONTENT : POPULATION DENSITY

- OBJECTIVES: 1. *To develop the idea that the earth has a limited capability to sustain life.*
2. *To compute the number of objects that will fit in a certain space.*
3. *To understand how one can predict future population figures.*

GRADE LEVEL: MIDDLE AND HIGH SCHOOL

SCOPE & SEQUENCE NO.: V.C.7

Class Exercise:

Hand out a problem sheet with the following nine problems the day before beginning the unit. Let students make any reasonable assumptions necessary to a solution, but tell them to indicate their assumptions on the answer sheet. There is no single right answer for many of these questions. Answers will depend on student backgrounds.

1. How many shoe boxes ($1/2$ ft x $1/3$ x 1 ft) will fit into a steamer trunk (3 ft x 3 ft x 5 ft)?

Answer: volume of shoe box $v = l \times w \times h = 1/6$ ft³

volume of steamer trunk $v = 45$ ft³

of objects $\frac{\text{volume of large area}}{\text{volume of single object}} = \frac{45 \text{ ft}^3}{1/6 \text{ ft}^3/\text{box}}$

= 270 boxes, an exact number.

2. How many cars can fit on a parking lot (300 ft x 150)?

Answer: Some possible assumptions: Car size?

Do you leave aisles?

How many levels?

A student can make any assumptions for car size - for 7' x 12' and no aisles

area car - 84 ft²/car

area lot - 45,000 ft²

of cars = $\frac{45,000 \text{ ft}^2}{84 \text{ ft}^2/\text{car}}$

= 525 cars

range 300 - 1000 cars.

There is more than one reasonable answer.

3. How many houses will fit on 100 acres of land?

Answer: Possible assumptions: number of streets

open spaces

recreation areas

number of houses per acre

Assume - 1 house occupies $1/4$ acre

Answer: 400 houses maximum

Assume - 1 house occupies 2 acres

Answer: 50 houses maximum.

4. How many people can live in your apartment or home?

Answer: Assumptions: nationality
size of home
number of bedrooms
how long will they stay - a weekend or
year?
zoning

Discuss: How did they make their choice?
Did they need privacy?
Did they need room to feed people?
Did they need recreation area?
Did they need empty space?

5. How many students will your classroom hold? Comfortably?

Answer: Value judgement: 15-30 students.
A teacher may relate the students' answer to population growth later. As population grows either more classrooms must be built or more students must go in each classroom. Do the students feel a small class size maximizes learning? What effect does a large class have on learning?

6. What is the maximum number of people that can live in your city or town?

Answer: Open ended. Emphasize the difficulty of predicting a maximum population for such a large area. The class should realize that, even though the limit cannot be exactly predicted, a finite limit exists on the number of people that can be accommodated. Discuss the importance of resources such as food and water. Have the class distinguish between absolute limits and desirable numbers.

Optional:

7. How many fish can live in a 20-gallon aquarium?

Answer: Assumptions: size of aquarium
size of fish
type of fish
oxygen source - plants or mechanical?

No correct answer. Allow discussion to include need for life support, e.g. food, oxygen, spawning area, waste removal.

Generally, goldfish need 1 gallon of water for every 2½ inches of body.

8. How many people will fit in a car?

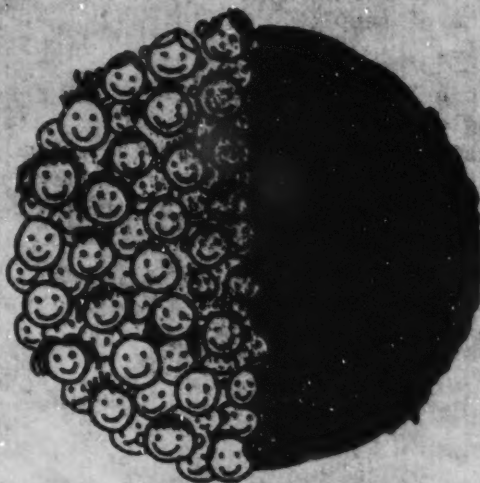
Answer: Assumptions: size of car
size of people
Range: 2-9 people.

9. How many cows can live in a 2-acre pasture?

Answer: On Western grassland, each cow needs approximately 5 acres for grazing. If a farmer provides food from an external source, more cattle can be accommodated in a smaller area, e.g. feedlots. In a feedlot 100 - 300 cattle/acre.

Excerpted from: Schaefer, Lawrence M. *An introduction to population, environment and society; a three-to-five week unit for high school students.* Hamden, Conn., E-P Education Services, 1972, p. 1-3.

WOULD YOU BELIEVE



... that half of the world's population are children? There are nearly 4 billion people in the world, and if you were to sit down and count even to a million children every second of the day, you would be counting for 11 days, 13 hours, 46 minutes, and 40 seconds.

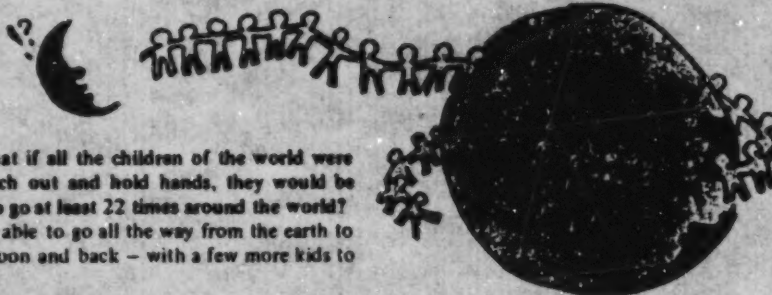
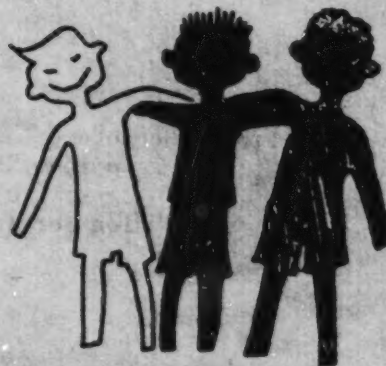
... that counting to a billion would take you 31 years, and thus if you count the population of the world you won't live through it because it would take 120 years to do so?

... that if Chinese is spoken as the mother tongue, then it would be widest spoken language in the world. The population of China is the largest in the world, and there are also many Chinese living in all parts of Asia and America. Thus, it is logical that more people would be speaking Chinese.

... that if all the Filipinos were to hold hands they would be able to go around the world?

... that ants have the biggest population of any dry land creature in the world? Ants can fit themselves into any situation: any soil, rotten wood or cracks in a house will do for a home.

... that every person in the world has the same kind of pigment in his skin? Whether you are fair or dark, brown like a Filipino or black-skinned like the Negro, depends only upon the proportion of light or dark pigment in your skin.



... that if all the children of the world were to reach out and hold hands, they would be able to go at least 22 times around the world? Or be able to go all the way from the earth to the moon and back - with a few more kids to spare?

This is a reading passage for young people from: *For Children: the Fun-to-Learn-and-Do Magazine*, Vol. 1, no. 5, 1974, p. 16.

CONTENT : HUMAN FERTILITY

OBJECTIVES: *To help pupils know that human fertility patterns can change, and to suggest to them that such changes can be voluntarily controlled.*

GRADE LEVEL: HIGH SCHOOL

SCOPE & SEQUENCE NO.: V.E.1

Previous learnings: The reproductive period of a woman's life is confined to about 30 years, from about 15 to about age 45; 'Fertility' is distinct from 'fecundity'.

(The italicised sections represent the kinds of motivating and stimulating questions, problems, or situations which the teacher may generate in class during discussions).

In today's exercise, suppose that we have completed a survey. The purpose of the survey was to study the fertility pattern of a certain region in Sri Lanka - the South West Coast.

What is meant by the term 'fertility'?

('Fertility' denotes the actual number of children a woman bears during a given period of time. 'Fecundity' denotes the maximum number of children she could have borne during the same period of time. If we take the 30 years or so of the reproductive period of a woman's life, from the age of, say, 15 years to 45 years, and if we find that she has borne 3 children during this period, her fertility is 3 children, whereas her fecundity might have been, say, 15 children).

Suppose that we have visited many hundreds of households in the area and interviewed all the married women, say some 2,500 of them, in the area. We have asked them for their ages.

Let's put down a column for these ages by five-year age groups and a second column giving the number of women in each of these age-groups.

(With the pupils' co-operation, put down the columns on the black-board. They should look like columns 1 and 2 in Table A. Try to get the pupils to verbalize the headings for the two columns. Don't put down any other columns yet! Say that you are excluding the data for the age groups below 25 years and over 80 years because they are not of immediate interest to you. TABLE A IS AT THE END OF THIS UNIT).

In reply to questions from us, the women have kindly told us how many children they bore and when each child was born.

Here are the figures we collected.

(Put up the rest of the column headings as shown in Table A. Then write in the figures 392, 355 and 329 as shown in column 3 of Table A, and ask -)

What's this 392 here?

(Elicit the understanding that the survey showed that the 327 mothers who were 25-29 years at the time of the survey had given birth to 392 babies when the 327 mothers had been 20-24 years old).

What's the 355 and 329 here?

(The 284 mothers aged 30-34 years at the time of the survey had given birth to 355 babies when these 284 mothers had been 20-24 years

old. The 286 mothers aged 35-39 years at the time of the survey had given birth to 329 babies when 286 mothers had been 20-24 years old).

Can we say that the women who are now 35-39 years old were less fertile than the women who are now 25-29 years old, when we compare their fertility figures for the 20-24 year period of their lives? It's 329 versus 392.

(Elicit the understanding that the numbers of women in the two groups are different, viz. 286 and 327 respectively. In order to compare the fertility of the groups, a correction should be made for this).

What correction shall we make?

(We may, for example, express the fertility as so much per 100 women).

Now, for the completed table.

(Give each pupil a copy of table B. SEE THE END OF THIS UNIT).

The Table has no heading. A table should have a heading. Let's devise a heading.

(Allow several minutes for the pupils to devise a heading. Then choose the best of them. A suitable heading might be: Fertility of women at different periods of their lives, mid-1960's, South West Coast of Sri Lanka).

Look horizontally along the rows of figures in columns 3 to 8. Do you notice a pattern?

(Generally speaking, the figures in each horizontal row increase to a peak in column 4 or 5 and then decrease progressively in columns 6 to 8).

What interpretation would you place on this pattern?

(Fertility was maximal when the women were 25-29 years old or 30-34 years old. After that, fertility decreased markedly and was negligible after the age 45).

Why did fertility decline after age 35?

(Elicit the recognition that we cannot answer this question with the present data alone. We can only make guesses. One possibility is that there is a true physiological decrease of fertility. Another possibility is that the women may be voluntarily avoiding conception).

Now look vertically up and down the columns. Look for a pattern, if any.

(Allow time for this. In columns 6, 7 and 8, the figures seem to decrease from below upwards. In column 3, the opposite is possibly the case. In columns 4 and 5, there is no clear trend).

How would you interpret the decreasing figures as you go up columns 8, 7 and 6?

(A reasonable interpretation is that it is becoming unfashionable, in recent years in the South West Coast of Sri Lanka to have children after the age of 35 years. Another interpretation is that at the time of the survey, the older women supposed that they had their children at later ages than was actually the case. A far-fetched interpretation is that women over 35 years have recently been losing their fecundity).

Does this suggest that fertility can be controlled?

(Yes, if the interpretation is accepted that it is becoming unfashionable to have children after the age of 35 years).

We have left out of consideration several matters that could influence the reliability of the data. Can you mention some of them?

(For example: What was the sampling procedure that was used in selecting the households for the survey? What was the technique of interviewing? Did it minimize the chances of getting false answers? How reliable were the statements of age made by the women? How reliable were the memories of the women with regard to the ages at which children were born to them?)

Assignment/Evaluation:

1. Summarise our conclusions in a sentence or two.

(For example: The data that have been presented show that the fertility of mothers in the 35-45 years age group has recently been decreasing in the South West Coast of Sri Lanka. The cause of the decrease is unknown, but one possibility is that it is becoming socially unfashionable for a mother to have children after the age of 35 years).

2. The table below gives data for the fertility rates of women of various age groups in Sri Lanka and in the Vavuniya District of Sri Lanka in 1960.

Age group	Fertility rate of the stated age group (Number of births per 1,000 women in the stated age group)	
	Sri Lanka	Vavuniya District
15 and under 20	68	267
20 and under 25	227	381
25 and under 30	262	396
30 and under 35	257	387
35 and under 40	155	197
40 and under 45	44	49

- (a) Give at least two reasons which might account for the relatively lower figure for the fertility of the age group '15 to under 20'.

(For example: The proportion of married women in this age group may be low; reproductive maturity, i.e. the ability to bear children, may not have been attained by all the women in this age-group; the women in this age-group may be practising contraception to a great extent).

- (b) Which of these reasons do you consider to be the best?

(The proportion of married women in the age-group '15 and under 20 years' being low).

- (c) Give at least two reasons which might account for the low figure for the fertility of the age-group '40 and under 45'.

(For example: A proportion of the women may have reached the age of physiological infertility, a high proportion of women in this age-group may be practising voluntary restriction of conception).

Table A

Present age of mothers (years) (1)	Number of mothers in the stated age group (2)	Number of children born to the mothers when these mothers were					
		20 - 24 years old (3)	25 - 29 years old (4)	30 - 34 years old (5)	35 - 39 years old (6)	40 - 44 years old (7)	45 - 49 years old (8)
25 - 29	327	392					
30 - 34	284	355					
35 - 39	286	329					
40 - 44	182						
45 - 49	189						
50 - 54	160						
55 - 59	103						
60 - 64	75						
65 - 69	72						
70 - 74	43						
75 - 79	26						

Source: Abhayaratne, O.E.R., and Jayewardene, C.H.S., *Fertility trends in Ceylon*, page 227, Colombo, 1967

Table B

Present age of mothers (years)	Number of mothers in the stated age group (2)	Number of children born to the mothers (per 100 mothers) when these mothers were:					
		20 - 24 years old (3)	25 - 29 years old (4)	30 - 34 years old (5)	35 - 39 years old (6)	40 - 44 years old (7)	45 - 49 years old (8)
25 - 29	327	120					
30 - 34	284	125	140				
35 - 39	286	115	140	115			
40 - 44	182	125	160	120	75		
45 - 49	189	100	145	130	70	20	0
50 - 54	160	115	135	120	60	20	0
55 - 59	103	80	135	140	85	40	5
60 - 64	75	95	145	130	90	45	
65 - 69	72	105	140	150	125	60	15
70 - 74	43	85	135	140	120	60	15
75 - 79	26	50	135	125	110	70	10

Source: Abhayaratne, O.E.R., and Jayewardene, C.H.S., *Fertility trends in Ceylon*, page 227, Colombo, 1967.

Excerpted from: Unesco. Regional Office for Education in Asia. *Population and family education draft sample instructional materials - science/mathematics*. Bangkok, 1971, p. 26-30.

CONTENT : MORTALITY

- OBJECTIVES: 1. *To help pupils know that the risk of death at childbirth is greater to a mother who already has several children as compared with the risk of death at childbirth to a mother who has only one or two children. To help the pupils know that the safest age for children from the point of view of maternal mortality is the age of 20-24 years.*
2. *To help pupils recognize that data are required before some questions can be answered; to help pupils develop skills in interpreting tabulated data.*

GRADE LEVEL: MIDDLE AND HIGH SCHOOL

SCOPE & SEQUENCE NO.: V.E.2

Procedures: The italicised sections represent the kinds of motivating and stimulating questions, problems and situations which the teacher may generate in class during discussions.

1. Relation between maternal mortality rate and order of childbirth.

What is meant by maternal mortality?

(This a recall question. Maternal mortality means the death of mother associated with childbirth).

What is meant by maternal mortality rate?

(The pupils should recall that the maternal mortality rate is the number of mothers who died at childbirth during a given year for every 1000 mothers who were at childbirth during the same year).

Do you think that maternal mortality rate is related to the number of children which a mother has had earlier?

(Help the pupils to recognize that this question cannot be answered without looking at the relevant data).

I have here some data bearing on this question.

Put the following table on the blackboard:

<u>Maternal mortality rate by order of childbirth</u>	
<u>Order of childbirth</u>	<u>Maternal mortality rate</u>
1	1.84
2	1.52
3	3.47
4	4.41
5	7.69
6	8.08
7-9	10.56
Over 10	51.38

When is the maternal mortality rate the lowest as related to the number of childbirths?

(The data suggest that the 2nd childbirth is the one that is associated with lowest maternal mortality rate).

Do you notice any trend in the maternal mortality rate in relation to the order of childbirth from the above data?

(The trend is that the maternal mortality rate increases progressively after the 2nd childbirth. At the 4th childbirth the maternal mortality rate is almost 3 times as high as the maternal mortality rate at the 2nd childbirth).

2. Relation between maternal mortality rate and mother's age.

Is maternal mortality related to the mother's age at the time of childbirth?

(Have the pupils recognize that without data it can be only guess work).

Here are some data from the same source as before.

Maternal mortality rate by age group

<u>Mother's age group in years</u>	<u>Maternal mortality rate</u>
20-24	2.28
25-29	2.85
30-34	4.31
35-39	9.36
40 and over	21.49

*In which age group is the maternal mortality rate highest?
(In the age group of 40 years and over).*

What is the relationship between mother's age and maternal mortality rate?

(The maternal mortality rate is lowest in the 20-24-year age group. In the older age groups maternal mortality rate rises progressively with age).

What is the maternal mortality rate of mothers under 20 years of age?

(The question cannot be answered from the above data. You may say however that other series of data have shown that the maternal mortality rate is higher for the under-20-year age group than it is for 20-24-year age group).

Summarize the main concepts by asking recall questions such as:

Which childbirth seems to be the safest from the point of view of maternal mortality? (The 2nd childbirth). Which age seems to be safest for the mother to have her child from the point of view of maternal mortality? (The 20-24 year age group).

Assignment/Evaluation

They can be recall questions such as: What do you understand by the term "maternal mortality"? What is meant by the term "maternal mortality rate"? What age group is the safest for childbirth from the point of view of maternal mortality?

Or comprehension questions such as: What is the relationship be-

tween the number of childbirths and maternal mortality rate? How much greater is the maternal mortality rate for 4th childbirth and over as compared with the maternal mortality rate at the 2nd childbirth? Compare the age group of 20-24 years with age group of 35-39 years and over, regarding maternal mortality rate.

Or more complex questions such as: Is it necessary to see more data on this subject? Give reasons for your answer.

Excerpted from: Unesco. Regional Office for Education in Asia. *Population and family education draft sample instructional materials - science/mathematics*. Bangkok, 1971, p. 23-25.

CONTENT : POPULATION PROJECTIONS

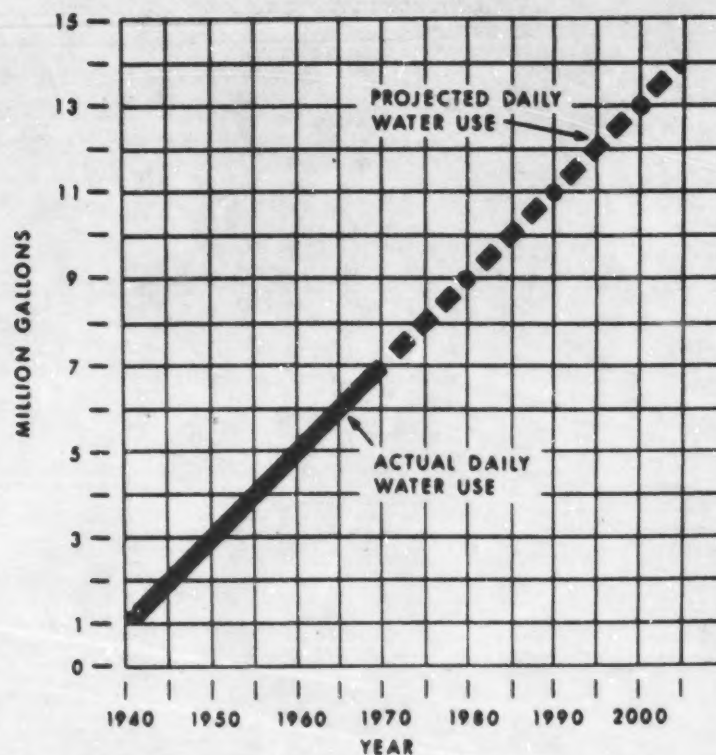
OBJECTIVES: *To understand how one can predict future water needs vis-à-vis population figures.*

GRADE LEVEL: UPPER PRIMARY/LOWER SECONDARY

SCOPE & SEQUENCE NO.: V.F.3

Text for Students: Looking into the future, Government planners often need information about future populations. To get this information, the demographer makes a projection which is a careful guess about the future population. Let us see how two towns, one name Lek and the other, Yaay, would carefully guess (or project) their future needs for water.

Lek is a growing town. As the town's population grew, its use of water each day also grew. Lek needed about 1 million litres of water for each day in 1940, 3 million litres for each day in 1950, 5 million litres in 1960 and 7 million litres in 1970. The demographer has shown these increases in a graph.



Now the town government wants the demographer to tell how much water Lek will probably need in 10, 20 and 30 years. A projection is needed. The demographer continues the line of the graph past the years 1980, 1990 and 2000. (See the broken line.) He places a dot on the broken line directly above each of these three dates. By reading the number to the left of each dot, the demographer projects these numbers: 9 million litres in 1980, 11 million litres in 1990 and 13 million litres in 2000.

Can you make a projection to look into the future? The town of Yaay is growing much faster than Lek. Its town government is worried about future water supplies. Imagine that you are the demographer and they ask you for help. Here is the record of water used each day in Khaaw Yaay: 1 million litres in 1940, 4 million litres in 1950, 7 million litres in 1960, 10 million litres in 1970. Make a graph for Yaay like the one of Lek. The town government wants to know how much water the town will need in 1980, 1990 and 2000. What will you tell them?

Adapted from: Lowenherz, Robert J. *Population*. Mankato, Minn.,
Creative Education Press, 1970, p. 49-50.